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Manufacturers' Inventories and Inventory Investment

Analysis of the Department of Commerce total stock series in the present chapter yields several important findings. Both total manufacturers' stocks and inventory investment are shown to have turned somewhat earlier in relation to business cycle turns since 1946 than Abramovitz indicated was characteristic of the prewar period. Nevertheless, movements in quarter-to-quarter change in inventories (i.e., inventory investment) have well-defined cyclical patterns in most of the series and show a high degree of conformity to both industry sales cycles and business cycles. Durable-goods series were cyclically more sensitive than those of nondurable goods, showing a higher conformity to business cycles and moving with greater amplitude. Stocks in durable-goods industries have been relatively larger since the war, and their increased importance has altered the composition of total stocks.

Timing Comparisons

During the 1946–58 period, total stocks lagged behind reference turns by 1 to 8 months (table 8 and chart 3), in contrast to Abramovitz' estimate of a 6-to-12-month prewar lag.[1] Total investment timing varied from roughly coincident to a lead of 14 months (table 9 and chart 4), compared to Abramovitz' coincident timing estimate.

[1] It will be noted that timing of the two most recent turns in table 8 is based upon book value data.

TABLE 8.—*Timing and conformity of manufacturers' total inventory at reference and activity turns; comprehensive series*

A. TIMING MEASURES [1]

Industry	Lead (−) or lag (+) in months—Business cycles					
	Peak November 1948	Trough October 1949	Peak July 1953	Trough August 1954	Peak July 1957	Trough April 1958
	Timing at reference turns					
Total, manufacturing	+4	+6	+2	+1	+2	+8
Durable goods industries, total	−14	+4	+2	+9	+3	+8
Nondurable goods industries, total	[2]	[2]	+2	+1	+1	+5
	Timing at activity (sales) turns					
Total, manufacturing	+6	+4	+2	−1	+8	+9
Durable goods industries, total	−15	+4	+2	+7	+9	+8
Nondurable goods industries, total	[2]	[2]	[3]	[3]	+7	+6

B. SUMMARY OF TIMING (16 INDUSTRY SERIES) [4]

	At business cycle peaks		At business cycle troughs	
	Number	Percent	Number	Percent
Leads, more than 3 months	6	22	2	7
Rough coincidences	12	45	10	37
Leads, 3 months or less	(8)	(30)	(3)	(11)
Coincidences	(0)	(0)	(0)	(0)
Lags, 3 months or less	(4)	(15)	(7)	(26)
Lags, more than 3 months	9	32	15	56

C. SUMMARY OF CONFORMITY [4]

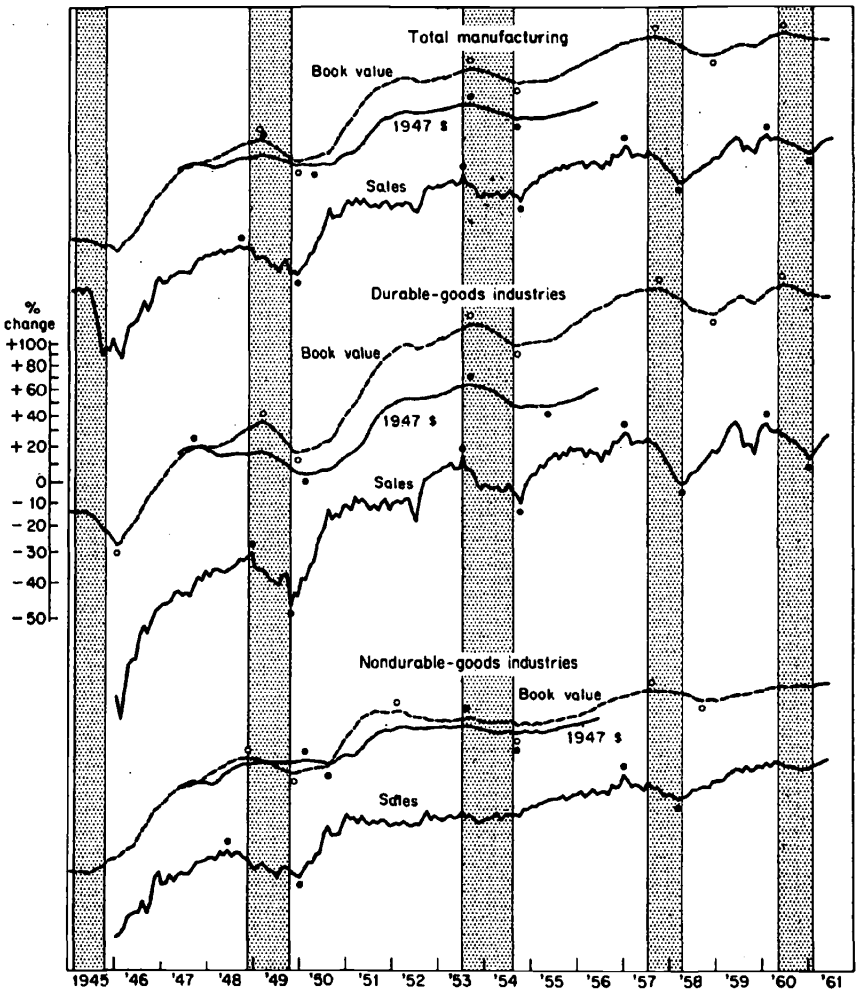
	16 industry series		7 durable goods industries		9 nondurable goods industries	
	All turns	All turns except Korean	All turns	All turns except Korean	All turns	All turns except Korean
Comparisons with reference turns:						
Number of comparisons	96	64	42	28	54	36
Matching inventory turns	65	54	30	28	35	26
Percentage of matching turns	68	84	71	100	65	72
Comparisons with output turns:						
Number of comparisons	75	53	38	28	37	25
Matching inventory turns	54	48	30	28	24	20
Percentage of matching turns	72	91	79	100	65	80

[1] Inventory series have been deflated to 1956; 1957–58 turns based on undeflated data. Korean cycle reference turns are not shown, since there were no corresponding inventory turns.
[2] No corresponding inventory turn.
[3] Inventory turn occurs, but no sales turn.
[4] Analysis includes only deflated 1948–56 data.

Source: Based on material from Department of Commerce.

CHART 3

INVENTORIES AND SALES: TOTAL MANUFACTURING, DURABLE- AND NONDURABLE-GOODS INDUSTRIES, 1945–61



Shaded areas represent business contractions; unshaded areas, expansions.
Dots identify peaks and troughs of deflated inventory cycles; circles, of undeflated cycles. All sales data are undeflated.

Source: Department of Commerce. Data deflated by the author.

It should be noted, however, that the prewar estimates were based on year-end data and hence are necessarily less precise. Abramovitz estimated from the annual data the range within which inventory and inventory investment turns would lead or lag behind reference turns on a monthly basis. Using his method, I have estimated the range of timing for total manufacturers' deflated inventories from

postwar annual data. These estimates may be compared with actual timing as follows:

Reference turn	Timing	
	Estimated range	Actual
Peak November 1948	+3 to +12	+4
Trough October 1949	0 to +9	+6
Peak July 1953	+3 to +12	+2
Trough August 1954	+3 to +12	+1

The consensus of Abramovitz' findings for the prewar period was for longer lags than these. Two of his turns showed a minimum lag of 12 months. I agree with Abramovitz that lags were typically somewhat longer before the war, but it seems likely that the range was greater than he indicated. Evidence of this is to be found in Department of Commerce estimates of the book value of manufacturers total stocks (quarterly, 1926–38, monthly thereafter) and in National Industrial Conference Board estimates (monthly, 1929–44). Prewar timing measures for these series are as follows:

Date of reference turn	Timing at peak		Timing at trough	
	Department of Commerce	NICB	Department of Commerce	NICB
October 1926	−3½			
November 1927			−7½	
August 1929	+7½	+5½		
March 1933			+3½	+2½
May 1937	+4½	+6½		
June 1938			+12½	+12½

During the postwar period a tendency for the inventory series to turn earlier at peaks than troughs, as compared with both reference and activity series may be observed (table 8). This finding is less well established in the comprehensive series than in the individual industry series and is offered only as a tentative observation.[2]

Table 8 shows the timing of movements in the comprehensive series. In two sets of comparisons (the turns which were related to the recessions of 1948–49 and 1957–58) stocks show shorter lags at peaks than at troughs; in the remaining comparison they do not (see also chart 3). The departure from the observed tendency is not so damaging as might at first appear, for the trough in stocks has been marked at the technically lowest point of an almost flat-bottomed recession phase which extends 10 months after the date of the trough selected. In the industry data, the evidence is more impressive.

[2] In this chapter and the chapters which follow, inventory and inventory investment turns are compared both with turns in the comparable sales or output series and with business cycle reference turns. This is a necessary, if somewhat repetitious, procedure; inventory behavior in a given industry or group of industries must be presumed to be functionally related to economic activity as represented by sales or output (typically, the two move together closely). It is essential, therefore to relate movements in stocks or investment to activity. At the same time, in order to generalize regarding behavior of inventories during business cycles and to compare the timing of one inventory series with another, it is essential to make direct timing comparison with reference turns. In addition to the NBER business cycle reference turns, use has been made of the two subcycle reference turns established for the Korean war period by Ruth Mack. For a discussion of subcycles and the criteria involved in establishing subcycle chronology, see Ruth P. Mack, "Notes on Subcycles in Theory and Practice," American Economic Review, May 1957, pp. 161–174.

The summary of timing comparisons for the 16 series (table 8) shows that 47 percent of the peaks in the inventory series lagged behind reference peaks, whereas 82 percent of the inventory troughs lagged behind reference troughs.

The tendency for shorter lags at peaks holds for both of the two cycles for which industry data were studied (1948–49 and 1953–54). During the first postwar business cycle, 54 percent of inventory peaks lagged behind the reference peak, and 73 percent of inventory troughs lagged behind the reference trough. For the second cycle the figures were 42 and 92 percent, respectively.

We shall see, however, that the generalization does not extend to inventory investment which turns relatively early at activity and reference peaks and troughs. Some instances of earlier timing at peaks than at troughs may be noted, but there is no consistent pattern.

The tendency of quarterly inventory investment series (quarter-to-quarter change in inventories) to move in well-conforming cyclical patterns was found in most of the individual industry series for total stocks and, as we shall see in the following chapters, by stage of fabrication as well.

The relatively high degree of conformity of the total inventory investment series to business and output cycles is clearly evident from the summary of conformity measures given in table 9. Industry investment turns could be consistently related with corresponding reference turns in 86 percent of possible comparisons, and with output turns in 87 percent.[3] This conformity is of roughly the same magnitude as that noted for total stocks series in table 8 (68 and 72 percent, respectively).

[3] A principal method of measurement used in this study was to record the number of turns in inventory or investment series that could be "matched" with reference or activity turns, using NBER rules for matching. Peaks in a series are said to match reference (activity) peaks when there is no intervening trough in either the reference (activity) cycle or in the series in question.

TABLE 9.—*Timing and conformity of manufacturers' total inventory investment at reference and activity turns; comprehensive series*

A. TIMING MEASURES [1]

Industry	Lead (−) or lag (+) in months							
	Business cycle		Korean cycle		Business cycles			
	Peak (reference, November 1948)	Trough (reference, October 1949)	Peak (February 1951)	Trough (June 1952)	Peak (July 1953)	Trough (August 1954)	Peak (July 1957)	Trough (April 1958)
	Timing at reference turns							
Total manufacturing	−6	−2	+3	−1	−2	0	−14	+1
Durable-goods industries, total	−6	−2	+6	−1	−2	−3	−20	+1
Nondurable-goods industries, total	−6	+7	+3	(2)	(2)	−9	−14	+4
	Timing at activity (sales) turns							
Total manufacturing	−4	−4	(3)	(3)	−2	−2	−8	+2
Durable-goods industries, total	−7	−2	(3)	(3)	−2	−5	−14	+1
Nondurable-goods industries, total	−1	+4	+4	(3)	(4)	(5)	−8	+5

B. SUMMARY OF TIMING (16 INDUSTRY SERIES) [6]

	At business cycle peaks		At business cycle troughs	
	Number	Percent	Number	Percent
Leads, more than 3 months	12		8	30
Rough coincidences	11		15	56
Leads, 3 months or less	(8)		(11)	(41)
Coincidences	(2)		(0)	(0)
Lags, 3 months or less	(1)		(4)	(15)
Lags, more than 3 months	5		4	15

C. SUMMARY OF CONFORMITY [6]

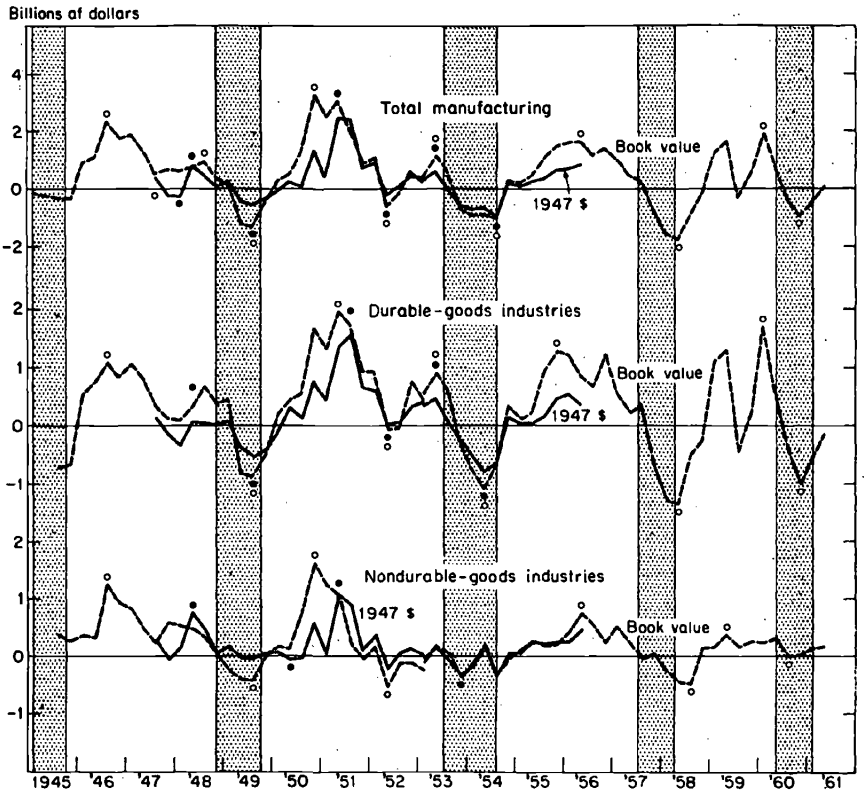
	16 industry series		7 durable-goods industries		9 nondurable-goods industries	
	All turns	All turns except Korean	All turns	All turns except Korean	All turns	All turns except Korean
Comparisons with reference turns:						
Number of comparisons	96	64	42	28	54	36
Matching investment turns	83	55	40	28	43	27
Percentage of matching turns	86	86	95	100	80	75
Comparisons with output turns:						
Number of comparisons	75	53	38	28	37	25
Matching investment turns	65	49	38	28	27	21
Percentage of matching turns	87	92	100	100	73	84

[1] Inventory series have been deflated to 1956; 1957–58 turns based on undeflated data.
[2] Sales turn occurs but no well defined corresponding inventory investment turn.
[3] No sales turn occurs.
[4] No sales or inventory turn occurs.
[5] Inventory turn occurs, but no sales turn.
[6] Analysis includes only deflated 1948–56 data.

Source: Based on material from Department of Commerce.

CHART 4

INVENTORY INVESTMENT: TOTAL MANUFACTURING, DURABLE- AND NONDURABLE-GOODS INDUSTRIES, 1945–61



Shaded areas represent business contractions; unshaded areas, expansions.
Dots identify peaks and troughs of deflated cycles; circles, of undeflated cycles.

Source: Department of Commerce. Data deflated by the author.

CYCLICAL SENSITIVITY OF DURABLE GOODS

Conformity measures point clearly to the greater cyclical sensitivity of durables. Turns in the durable-goods inventory series (table 8) could be matched with reference turns (except Korean) in 100 percent of comparisons; among the nondurables, only 72 percent. Similar figures for inventory investment (table 9) were 100 percent for durables and 75 percent for nondurables.

Amplitudes of fluctuations in inventory investment may be compared for durables and nondurables by means of a simple tabulation of the change from peak to trough and from trough to peak in investment cycles. Since total stocks of durable-goods industries on the average are not greatly in excess of nondurable (about 1.2 times as large) the results may be compared directly. The following tabulation (in billions of 1954 dollars at annual rates) shows that the change in level of inventory investment was far greater for durables than for

nondurables in all but one of the postwar phases for which deflated data were available.

Durables		*Nondurables*	
P-T I 49 to III 49	−2.8	II 48 to II 49	−2.9
T-P III 49 to III 51	+10.3	II 49 to II 51	+4.3
P-T III 51 to II 52	−9.5	II 51 to III 54	−4.4
T-P II 52 to II 53	+3.9	III 54 to III 56	+2.6
P-T II 53 to II 54	−6.7	III 56 to II 58	−2.9
T-P II 54 to I 56	+7.9	II 58 to IV 59	+2.6
P-T I 56 to II 58	−7.3		
T-P II 58 to I 60	−10.4		

This was not the result of one or two dominating series, but a highly representative performance. During the 1949 recession six of the seven durables inventory series showed declines of 10 percent or more from their peaks, whereas only five of the nine nondurables declined by this amount. During the 1953–54 recession five of the seven durables series declined 10 percent or more, but only one of the nondurables did so.[4]

Another characteristic of durables inventory movements is that the series move together; this makes for little muting of the impact through dissimilar and counteracting changes. This characteristic is clearly in evidence when diffusion indexes of percentage of series increasing were constructed for the durables and nondurables series. Among the durables the tendency for stocks to move together was indicated by very high scores (indicating that most series were rising) or very low scores (indicating that few series were rising), whereas among the nondurables the tendency for stocks to move in different directions was indicated by scores close to 50 percent. During the period extending from second quarter 1948 to second quarter 1955, scores were above 80 percent or below 20 percent more than half of the time for the durables and less than a sixth of the time for the nondurables.

There appear to be two types of causation for these well-established cyclical tendencies among the durables. In the first, the cyclical behavior appears to derive from greater fluctuations and more closely coordinated changes in activity among the several durables industries. In the second, the explanation lies in the composition of stocks; i.e., the inventories held at different stages of fabrication are of the types which are more responsive to cyclical forces.

The first point is readily established by applying the same test to output series that was used to show amplitude of movements in inventories. During the 1949 contraction, all seven durables output series declined by more than 10 percent of their cycle bases, whereas only three of the nine nondurables series declined by such amounts. During the 1953–54 recession, six of the seven durable output series declined by more than 10 percent, but only four of the nine nondurables declined by as much as this amount. In addition, diffusion indexes for output of durables showed a greater swing than nondurables during these two periods, indicating a closer intercorrelation in the movements of durables.[5]

The second type of causation will become apparent as the behavior of stocks at each stage of fabrication is analyzed, but the general argument may be stated here. Durables inventories are composed in a

[4] The declines were measured as percentages of the average level of stocks during each cycle.
[5] G. H. Moore, Business Cycle Indicators, Princeton for NBER, 1961, vol. I, pp. 283–284.

larger degree than nondurables of the types of stocks which move sensitively when manufacturing activity increases or decreases. Procurement of durable purchased stocks is largely demand oriented; it is not limited by supply conditions, as may be the case with certain nondurable agricultural raw materials. Durable goods-in-process stocks are held between stages (rather than within stages) to a much greater extent. It is these between-stage stocks which may be varied to the greatest extent with changes in demand conditions (chapter 6). Finally, durable goods are typically manufactured to order rather than to stock; this tends to cause finished stocks to respond more sensitively to cyclical forces.

By making use of Abramovitz' data, it is possible to determine the relative size of durable-goods manufacturers' stocks before the war and to learn whether they displayed as high a degree of responsiveness in that period. Table 10 shows the average proportion of total stocks made up by durables for each cycle from 1919 to 1958. In addition, it shows the proportion of the change in manufacturers' inventory investment in each phase which was caused by changes in durables investment. It can be concluded that durables stocks have constituted a larger share of total stocks in recent years, and have contributed in a greater measure to economic instability. The characteristic of high cyclical responsiveness, however, was well established in the earlier period.

Composition of Manufacturers' Stocks

We have seen that total manufacturers' stocks are smaller relative to output than they were before the war. Census data and Department of Commerce statistics indicate, in addition, that their composition has been significantly altered. Abramovitz estimated the prewar composition of stocks as 40 percent purchased materials, 20 percent goods in process, and 40 percent finished goods. The Annual Survey of Manufactures shows the 1952–53 proportion to be approximately 38 percent purchased materials, 29 percent goods in process, and 33 percent finished goods.

The proportions differ considerably for the durables and the nondurables groups. In the period 1952–54 the composition of durable and nondurable manufacturers' stocks was approximately:[6]

	Purchased materials	Goods in process	Finished goods
Durables	30	40	30
Nondurables	44	14	42
Total	36	28	36

The major difference in composition of durables and nondurables is, of course, the large stock of goods in process held by the durables group. These in-process inventories account for the large stocks-to-sales ratios of the durables group (approximately 2.1 to 1 compared to 1.6 to 1 for nondurables). The stocks-to-sales ratios for purchased

[6] The composition of total stocks given here was obtained from Department of Commerce data and is slightly different from that in the Annual Survey of Manufactures. The difference is due principally to the fact that the former are reported on a firm basis and include some finished stocks held by company distributing organizations, whereas census data are reported by individual manufacturing plants.

materials and for finished goods do not differ significantly between the durables and nondurables groups.[7]

The change in composition of manufacturers' stocks from prewar to postwar appears to be explained largely by the shift toward durables. Using the prewar ratios of nondurables to durables inventories (table 10) which is about 2 to 1, the prewar composition (if composition within durables and nondurables had been the same as postwar) would be 39 percent purchased materials, 23 percent goods in process, and 37 percent finished goods. These percentages are quite close to the actual prewar figures (40–20–20) as estimated by Abramovitz.

The significance of the behavior of stocks at each stage of fabrication is determined by the size of each category and by the amplitude and cyclical pattern of its movement. Judged on the basis of size it is clear that each category may be considered to be of substantial importance. Analysis of cyclical conformity, timing, and amplitude will be presented in the chapters which follow.

TABLE 10.—*Analysis of percentage of change in total manufacturers' inventory investment accounted for by inventory investment of durables manufacturers, 1919–61*

Cycle	Durables inventory as percentage of total inventory (cycle average)	Percentage of change in manufacturers' inventory investment accounted for by durables inventory investment [1]	
		Expansion	Contraction
Prewar:			
1919–20–21	38	76	46
1921–23–24	37	83	40
1924–26–27	43	(2)	(2)
1927–29–32	36	28	52
1932–37–38	35	39	40
Postwar:			
1946–48–49	52	(2)	50 (68)
1949–53–54	54	97 (84)	92 (82)
1954–57–58	54	95 (93)	112 (88)
1958–60–61	(3)	78 (74)	(2)

[1] Figures in parentheses are based on quarterly data.
[2] Durables inventory investment out of phase with total manufacturers' inventory investment and reference cycle.
[3] Not available.

Source: Prewar figures computed from deflated data in Abramovitz, "Inventories and Business Cycles," pp. 564–565. Postwar figures are in 1954 dollars; data from Department of Commerce.

[7] The changed composition of goods in process is treated in detail in chapter 6.